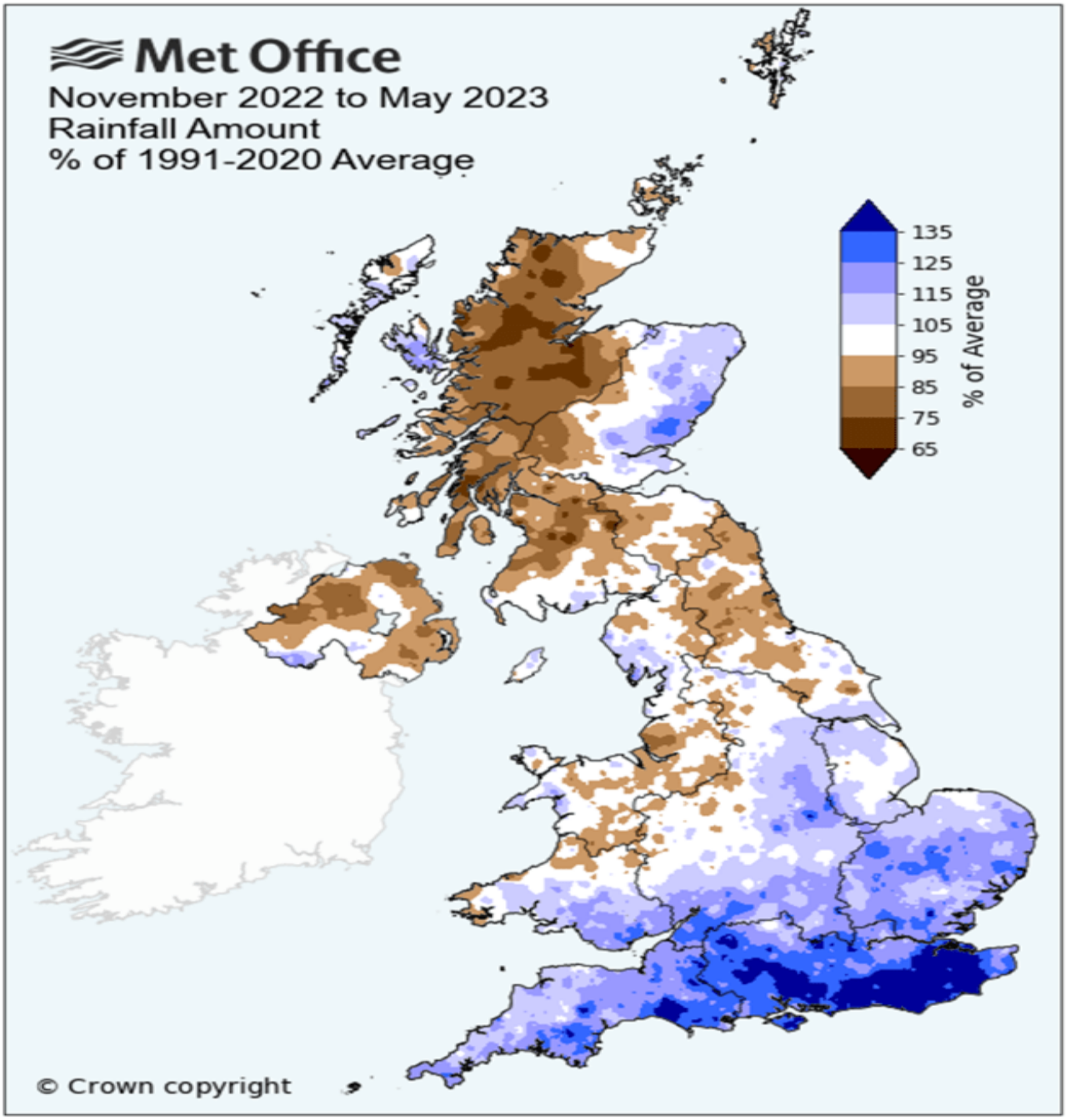
Relative lack of Spring rainfall triggers water scarcity alert

Description

With 1 June marking the first day of meteorological summer, we reflect on spring and ask whether it has been unusual in any way.



This map of the UK shows the rainfall over from November 2022 to May 2023 (inclusive) compared with average. The blue areas have experienced above-average rainfall for the seven-month period, whereas the brown shaded in brown have experienced below-average rainfall. The white areas of the UK have seen broadly

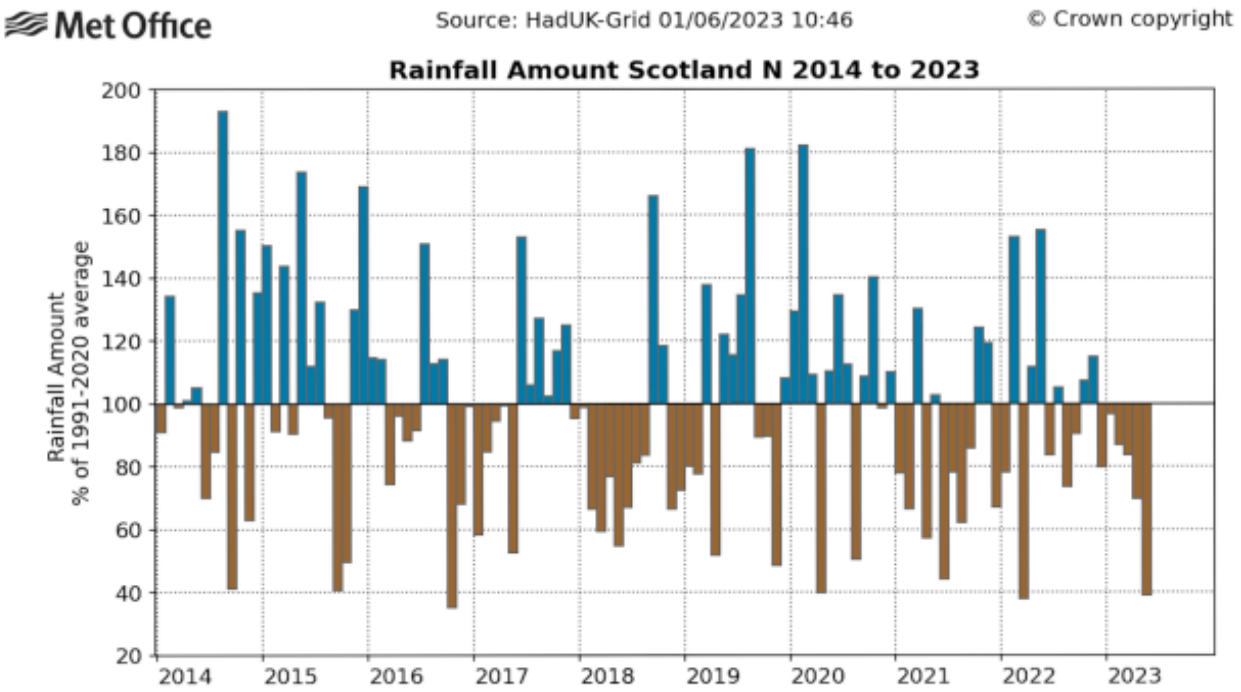
average rainfall.

To fully appreciate what spring has been like we need to put it into context by casting our minds back to winter; a season traditionally regarded as a recharge period for the UK's water supplies. UK rainfall over winter was down compared with average, with only 83% of average rainfall being recorded for the UK. This relative shortfall in a key period fuelled hopes for more rain to come for spring. Did it? Well, yes and no.

Spring rainfall across the UK has been very slightly above average (106%). But as always with averages, examining the detail can reveal interesting patterns. England has enjoyed well above average rainfall, with counties like Cambridgeshire recording around 161% of what they would in a typical spring. While the rain fell in England, especially during a very wet March, parts of Scotland – including Inverness and Sutherland – have only recorded just under two thirds of their expected rainfall (64%). This is the driest spring in North Scotland since 2018.

Spokesman for the Water Scarcity team at the Scottish Environment Protection Agency (SEPA), Stephen McGuire, said: "Spring and Summer are crucial times of year for water demand and SEPA started regularly reporting on water scarcity at the end of April. Initially, there were early warnings of water scarcity in the north and west of the Scotland with rainfall and river flows low for the time of year. But in recent weeks we have experienced more rapidly drying conditions and river levels are now very low across much of the Scotland.

"We have already issued alerts for water scarcity in the northwest and south central areas, and with little rain in the immediate forecast we expect the situation to escalate quickly and extend across a much wider area in the coming weeks. SEPA will continue to report weekly on the emerging situation."



This graph shows rainfall amounts for the Northern Scotland region over the last ten years. The descending brown bars show below-average rainfall per month while the ascending blue bars show above-average rainfall.

Spring temperature has been remarkably ‘average’ across the UK, but again the general picture masks lots of detail. After a colder-than-average start to spring, bouts of warmer conditions have helped to balance the books to bring values to average. Mean temperature for the UK has been 8.36°C; just over a quarter of a degree above the long-term average between 1991 and 2020.

It is worth noting that this spring is one of only three since 2000 where the hottest day of the year reached or exceeded 25.0°C on 29 May or later. This spring we saw 25.1°C at Porthmadog on 30 May. In contrast eight springs since 2000 have seen temperatures reach or exceed 25.0°C before the end of April. Compared with the average between 1991 and 2020, Northern Ireland saw the greatest difference to normal with temperatures here reaching 0.76°C above.

Sunshine in Spring 2023 was largely just below average. But with 106%, Lancashire was the sunniest county relative to average.

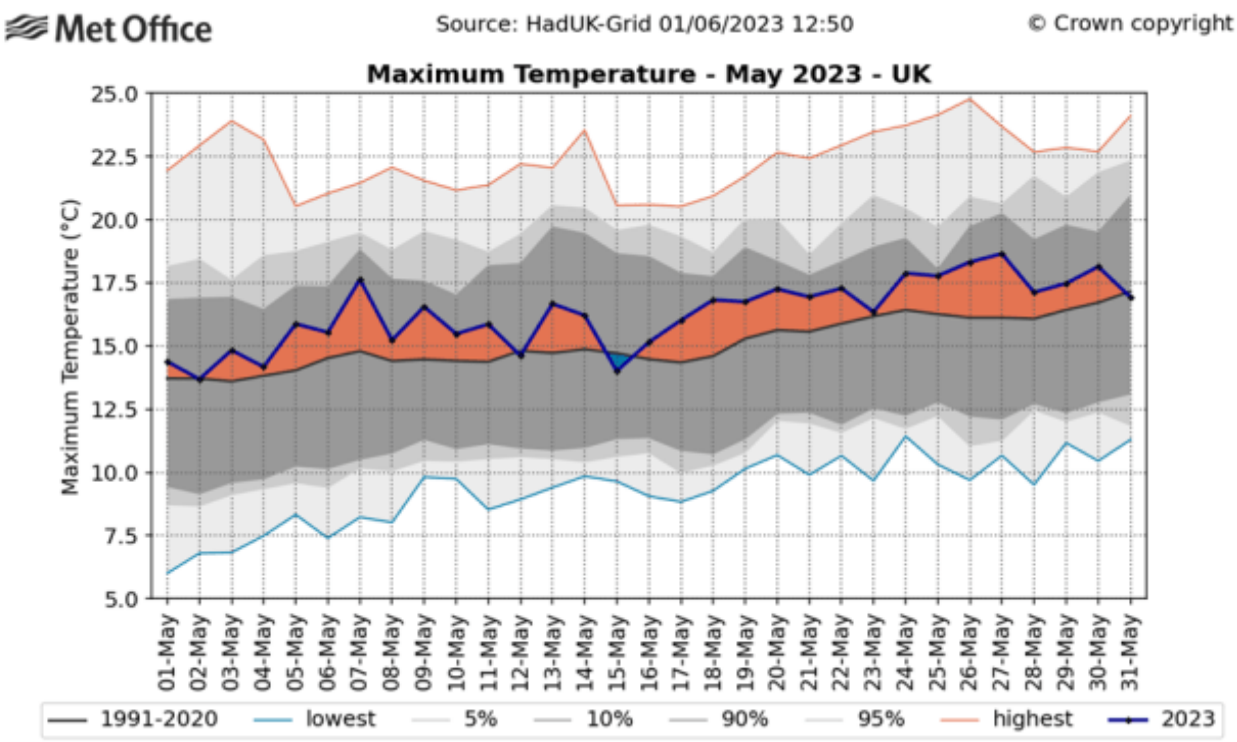
May 2023

Spring 2023 could be regarded as a more or less ‘average’ season, but May has more points of note.

The greatest talking point has been the relative lack of rainfall during the month. Across the UK, only 55% of expected rainfall was recorded (39mm), compared with the long-term average from 1991-2020. This makes May 2023 one of the driest Mays in recent times, although May 2020 was even drier with just 32.8mm.

Some locations recorded even less rainfall with Greater Manchester seeing only 39% of its average for May (26.6mm); making it the driest area of England relative to average. The driest area compared with average for the UK was Inverness which received only a third of expected rainfall. In contrast Cambridgeshire, Dorset and Norfolk all recorded above average rainfall.

Sunshine figures for May 2023 were mixed. Orkney, with just 95 hours saw the least sunshine compared with average for the islands in May since 1969. This was less than half what would be expected in a typical May. The sunniest county relative to average was Cornwall with 137% of average sunshine (289.5 hours).



This graph shows the daily maximum temperature averaged across the UK during May. Although much of the month was marginally above average (orange segments) none of these periods of relative warmth contained any significant peaks of heat.

The warmest locations compared to average (for Mean Temperature) were largely spread across Scotland, Northern England and Northern Ireland. Some of these locations saw average temp 1.4°C above the average for 1991-2020.

Mike Kendon of the Met Office's National Climate Information Centre concluded: "Although mean temperature for May has been above average, it is notable that we haven't seen any particularly significant peaks of above-average temperature especially during the second half of the month."

Date Created
June 2023

What is meant by Loss and Damage?

Description

And why are we talking about it?

Perhaps one of the most noteworthy outcomes of COP27 – the UN's climate summit held in Egypt in 2022 – was the historic decision to establish a Loss and Damage Fund.

The ground-breaking fund is designed to assist developing countries in responding to losses and damages.

Extreme weather events – made more extreme by climate change trigger losses and damage to local communities. Picture iStock

As planning for COP28 accelerates, the topic of Loss and Damage will once again be high on the agenda for Governments around the world. But this is a complex topic, and, as we begin to explore the theme this month, here we start with an explanation of what is meant by Loss and Damage.

Losses and damages

In simple terms, losses and damages refer to the financial, social and cultural shocks coming from the

inevitable climate impacts which can't be ameliorated by reducing greenhouse gas emissions (mitigation) or by taking measures to avoid impacts (adaptation).

The Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6) Working Group II Summary for Policymakers uses the term 'losses and damages' to refer to adverse observed impacts and/or projected risks of climate change. These impacts can be economic and/or non-economic.

Adverse impacts of extreme weather events and long-term climate changes (often known as slow-onset events and including effects such as sea-level rise and loss of biodiversity) create losses, including of human lives, land and loss of species. Damages from these events will affect, for example, livelihoods, infrastructure and ecosystems.

Economic losses and damages, such as the adverse impact on business or property, can be short or long-term and may also have global knock-on impacts beyond the immediately impacted region, for example to supply chains. Examples of non-economic losses and damages include loss of culture or identity and mental and physical health impacts.

Loss and Damage

The IPCC glossary definition of Loss and Damage references the political debate under the United Nations Framework Convention on Climate Change (UNFCCC) following the establishment of the Warsaw International Mechanism for Loss and Damage associated with Climate Change Impacts (WIM).

Dr Richard Jones OBE, of the Met Office, said: "Adverse impacts caused by human-induced climate change – losses and damages – are being felt across the globe, but the worst impacts are often felt in those regions least responsible for greenhouse gas emissions, but which are most vulnerable to extreme climate and weather events."

The WIM was established at COP19 in 2013 with the aim of addressing these losses and damages including through finance, technology and capacity-building. The COP27 funding agreement also seeks to tackle Loss and Damage, and a transitional committee is working on recommendations on how to operationalise the new funding arrangements to drive support for those most affected by climate change.

A complex picture

It is likely that the recommendations of the transitional committee and COP28 will bring Loss and Damage back into focus, and once again highlight the complexities of this debate. The IPCC AR6 Working Group II report is clear that human-induced climate change has already caused losses and damages to both nature and people and that these will escalate with every increment of global warming. It also highlights the need for a combination of climate change mitigation and adaptation, but acknowledges that, whilst future losses and damages can be reduced, even limiting global warming to 1.5°C along with effective adaptation cannot prevent all losses and damages.

As we explore this topic further, follow #GetClimateReady to learn more.

Date Created
June 2023

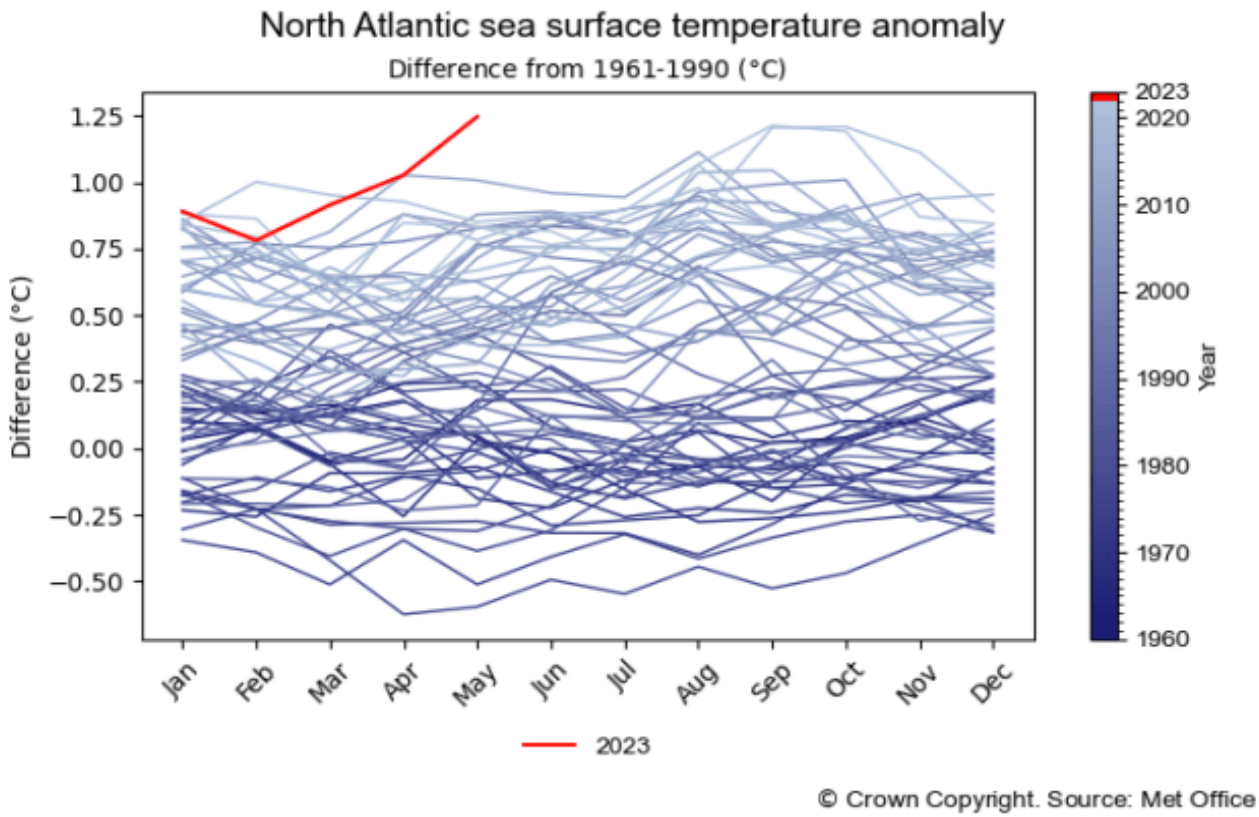
Sea surface temperatures breaking records

Description

The global sea surface temperatures for both April and May were the highest on record for those calendar months in a series stretching back to 1850. That is according to the HadSST.4.0.1.0 dataset compiled by the Met Office.

With the expected continued warming of the eastern tropical Pacific because of the emerging El Niño, it is likely that global sea-surface temperatures will challenge more records this year.

When you look at regional examples, the picture becomes even more stark. The temperature rise in the North Atlantic through May 2023 is record breaking.



The red line shows the sea surface temperature by month for 2023. The other lines indicate years back to 1960. Source Met Office

The month was clearly the warmest May on record since 1850, with temperatures about 1.25°C above the average over the reference period of 1961 to 1990. This difference relative to the reference period is known as the anomaly. May 2023 has seen nominally the highest anomaly of any individual month in the series.

What is driving this record-breaking heat at the ocean surface? Well, it is the classic combination of the underpinning of human-caused climate change with a layer of natural variation within the climate system on top. Climate change – driven by rising greenhouse gas emissions from fossil fuels, industry and land use changes – continues to warm the surface of the planet, both land and ocean. However, natural variation – including the warming and cooling phases of El Niño and La Niña respectively – creates modest deviations in the baseline global temperature that is rising overall because of climate change.

Professor Albert Klein Tank is the head of the Met Office Hadley Centre. Commenting on the situation in the North Atlantic, he said: “Typically, airborne dust from the Sahara helps to cool this region by blocking and reflecting some of the sun’s energy; but weaker than average winds have reduced the extent of dust in the region’s atmosphere potentially leading to higher temperatures.

“Additionally, lighter-than-usual trade winds could be playing a role.

“All of these elements are part of natural variation within the climate system which are coming together to elevate sea-surface temperatures to higher levels. It is not believed that these factors represent a

climate-change-induced tipping point that produces runaway temperatures. However, they will add to climate and weather impacts this year."

Climate scientists are also reviewing a number of other factors including: the warm phase of the Atlantic Multi-decadal Oscillation since 2020; reduced emissions from shipping; and a persistent weather pattern with easterly winds from the continent warming the sea surface.

What impacts will stem from elevated Atlantic sea-surface temperatures?

The eastern tropical Atlantic is the principal spawning ground for North Atlantic hurricanes. Meteorological records show that during periods influenced by El Niño that the development of hurricanes is suppressed in the north Atlantic because wind shear – winds crossing at different heights – tend to blow fledgeling hurricanes apart. However, forecasters have had to take into account the rise in sea-surface temperature as tropical cyclones derive their energy from warmer waters. The forecast this year from the Met Office suggests an above average season for the number of tropical storms and cyclones in the North Atlantic basin.

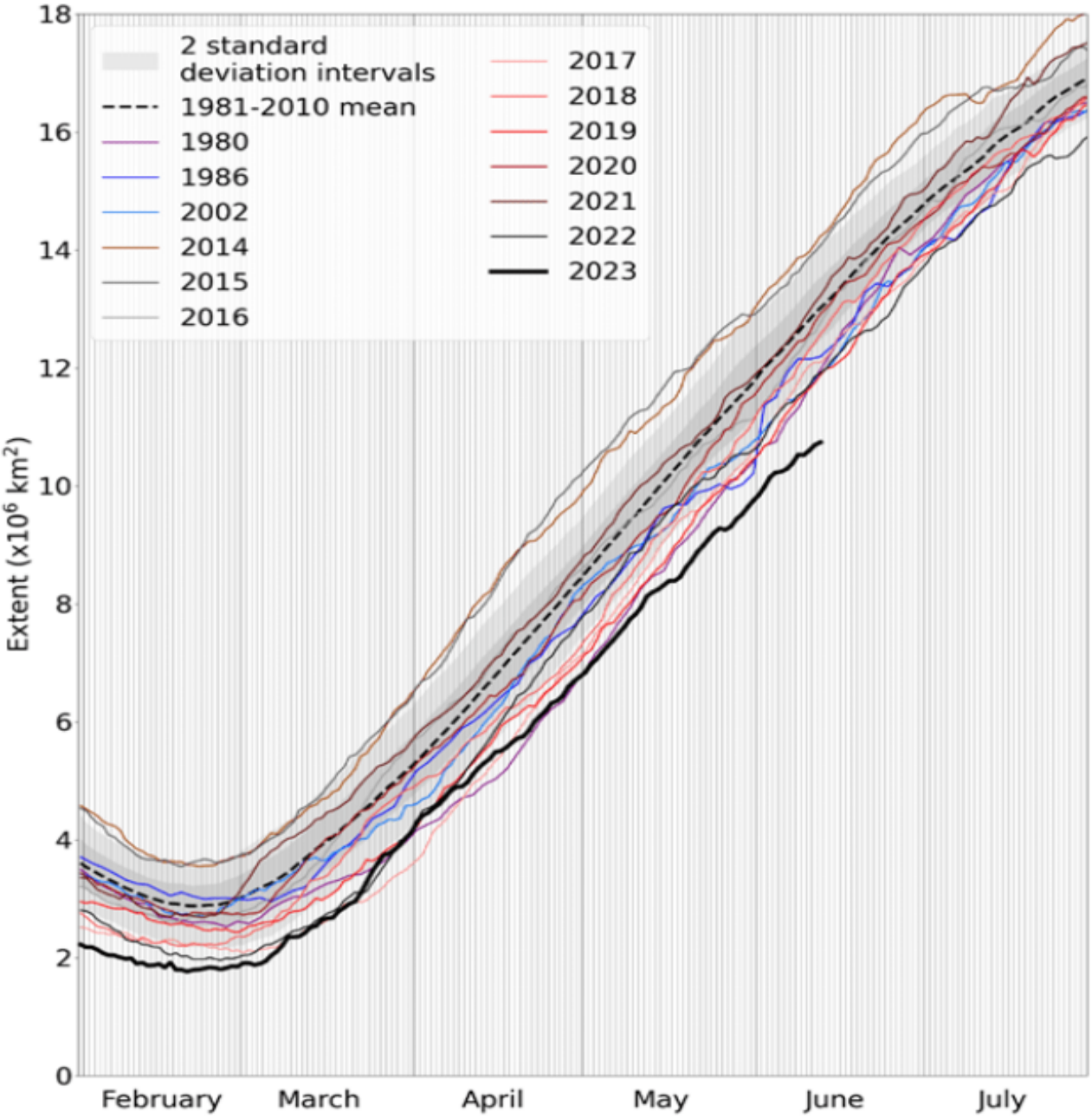
Julian Heming is a tropical cyclone expert with the Met Office. He said: "We are getting indications from models of an Atlantic tropical storm development east of the Caribbean by the middle of next week. This would be highly unusual in this area so early in the season. June storms normally form further west in the Caribbean or Gulf of Mexico. The high sea-surface temperatures in the tropical Atlantic would likely be one of the main factors if this development did happen next week."

Arctic and Antarctic sea ice

The Met Office has today [Friday 16 June 2023] published its latest report on the state of polar sea ice.

The report finds that Arctic sea ice extent is well below average for the time of year, but still above record low levels following near-average ice loss during May.

However, Antarctic sea ice extent is exceptionally low, the lowest on record for this date by a wide margin.



Daily Antarctic sea ice extent for 2023, compared with recent years and the low ice years of 1980, 1986 and 2002. Also shown is the 1981-2010 average with ± 1 and 2 standard deviation intervals indicated by the shaded areas. Data are from the National Snow and Ice Data Center (NSIDC).

Dr Ed Blockley is the lead of the Polar Climate Group at the Met Office. He said: “ Over recent decades we have seen a sustained loss in Arctic sea ice extent in every month of the year, but especially in late summer to early autumn. Although the current Arctic sea ice extent is considerably higher than the record low for the time of year, it is still well below the long-term average. Antarctic sea ice has been at very low levels since November 2016. This year we have seen Antarctic sea ice shrink to a record low-point for the time of year, following a second successive annual record minimum sea ice extent in February.”

The current low Antarctic sea ice extent, and recent record lows, are likely partly associated with unusually low sea level pressure in the Amundsen Sea. The ongoing period of low Antarctic sea ice has been linked to oscillations in tropical Pacific sea surface temperatures and Southern Hemisphere atmospheric pressure via El Niño and the Southern Annular Mode – a major feature of climate variability in the higher latitudes of the southern hemisphere.

Date Created
June 2023

May 2023: a record for UK sea-surface temperature says Met Office chief scientist

Description

The North Atlantic, including around the UK has been experiencing record-breaking temperatures.

Professor Stephen Belcher is the Met Office Chief Scientist. He said: “May 2023 has seen the highest temperatures of any May since 1850. But it doesn’t stop here. It has also been the highest month above average compared with any individual month in the series.”

Climate scientists often look at anomaly maps which compare current measurements with the average for a given long-term period.

Prof Belcher added: “Looking at the anomaly map for current sea-surface temperatures in the North Atlantic, some areas really stand out. You can see that the eastern Atlantic, from Iceland down to the tropics, is much warmer than average. But areas around parts of north-western Europe, including parts of the UK, have among some of the highest sea-surface temperatures relative to average.

“May 2023 was nominally the warmest May in the sea-surface temperature around the near-coastal waters of the UK since the late nineteenth century. The value is about 1.60 °C above the average for May over the period 1961-1990.”

Date Created
June 2023

The science of linking climate change to extreme weather events

Description

“Would this heatwave or severe rainfall have happened without climate change?” This is the kind of question that policymakers and businesses are asking scientists.

Climate attribution science can help us understand the answers to questions like this, as the probability and intensity of extreme weather changes in a warmer world. This will help countries, communities and businesses become more resilient to a changing climate.

Earlier this month we looked at what is meant by Loss and Damage.

A dwelling in Kerala lies almost submerged after heavy rainfall led to extensive flooding in 2018. Picture: Shutterstock

Climate attribution science plays a part in the evidence base needed in this complex area, and here the Met Office’s Dr Fraser Lott – a Climate Monitoring and Attribution Scientist – explains how attribution works and the challenges it presents.

What is an extreme weather and climate event, and how does it differ from a ‘normal’ event?

Extreme weather and climate events affect all aspects of society, and impacts can include large economic costs, displacement and loss of life. An extreme weather event – such as a heatwave or extreme rainfall – is defined as an event which ranks above a threshold, or is near the upper or lower ends of the historical range of values; making it significantly different from the usual weather pattern. For instance, this could be temperatures above a certain threshold for a sustained period. Some

extreme events would have happened within natural variability, but their likelihood will change with climate change. Climate attribution science can help us to identify this difference.

How does climate attribution help us to understand whether extreme weather is caused by climate change?

Climate-related attribution studies look at individual extreme weather events such as a heatwave and ask: “Would this have happened without climate change?” And if so: “How much hotter or longer is this heatwave because of climate change?” And: “How much more likely are these heatwave conditions because of climate change?” There is also climate trend attribution, which look at trends beyond individual extreme events.

Attribution science compares modelled worlds with and without the human influence on greenhouse gas emissions to understand the impact of climate change on the intensity and frequency of specific weather events. It can then say for instance: “climate change has made this heatwave 30 times more likely”. This is called an attribution statement.

How accurate is climate attribution?

Climate attribution studies rely on a lot of information, which means they have historically taken years to analyse whether a specific extreme event is linked to climate change. The last 20 years have seen huge developments in climate attribution; meaning that now scientists are able to conduct rapid climate attribution in a few days to weeks after an event. These are timescales relevant to the public and disaster recovery programmes.

Due to the speed of analysis, the scientists behind these rapid attribution studies do not always have time to conduct the extra simulations that would be part of a longer-term study of the specific details of the event. This leads to a trade-off between speed and level of confidence in the result, meaning we may need to make more general statements in a rapid study than we would in a scientific paper.

Confidence in the attribution studies also depends on the quality of observations going into the model, the ability of the models to simulate a particular type of extreme event, and how well the physical processes causing this extreme event are understood (as well as how they may change with climate change).

For instance, current climate models are good at replicating conditions which lead to extreme heat and cold, but it is harder to simulate conditions which lead to severe convective storms and tropical cyclones. This means confidence in attributing extreme events such as heatwaves to climate change is higher than attributing cyclonic activity to climate change.

Can climate attribution be applied to extreme weather across the globe?

The requirements for making a confident attribution statement mean that climate attribution is not yet used in all situations. For instance, regions that lack a reliable and sufficient set of historical observations (a problem encountered particularly in developing countries), will struggle to provide a dataset to base their model on. Not all climate models perform well over all regions of the globe. For example, some climate models do better in mid-latitudes compared to tropical ones, which can be a barrier to doing attribution studies in regions where climate models struggle to simulate the relevant

physical processes**.**

Developing countries – including those more vulnerable to extreme weather – can also lack resources, tools and training to perform studies. This can create a bias with attribution studies focussing on more developed nations in the global north, rather than being truly representative of extreme events which have occurred globally. This also means that scientists from the global north often need to conduct attribution studies for a region in which they are not experts.

The Met Office has been supporting the development of expertise in other parts of the globe, as well as helping improve observations, through work such as that delivered by the Weather and Climate Science for Services Partnership programme, supported by the UK Government's Department for Science, Innovation and Technology.

Carbon Brief has an interactive map of up-to-date attribution studies, and UK-based attribution studies can be found on the Met Office website.

In the next in our series of blog posts around the theme of Loss and Damage, we will be exploring how climate attribution science helps increase understanding and provide an evidence-base in relation to this complex topic. Follow this blog or #GetClimateReady on Twitter to keep up to date.

Date Created
June 2023

How does climate attribution science relate to Loss and Damage?

Description

In our recent blog post on Loss and Damage, we explored the climate change impacts caused by slow-onset events (such as sea-level rise) and extreme weather events. These different types of events resulting in losses and damages are also implicit in the Intergovernmental Panel on Climate Change (IPCC) 'Reasons For Concern' (RFCs). The latest assessment (Working Group II (WG2) Sixth Assessment Report (AR6)) finds that for a given level of warming, these climate-related risks are higher than previously assessed.

Many specific hazards are monitored on a continuous basis by climate research centres. For example, we previously looked at how sea level rise is monitored and the actions that can be taken in response to changing sea levels. Earlier this week, we also explored how climate attribution science compares modelled worlds with and without human greenhouse gas emissions or other human or natural drivers of climate change to quantify the influence of human-caused climate change on extreme weather and climate events.

Is climate attribution enough?

Dr Richard Jones OBE is a Science Fellow at the Met Office. He explained that “the extent of losses and damages, both economic and non-economic, during an extreme event will be determined by the scale of the hazard (meteorological and hydrological), together with the exposure and vulnerability of the people, communities, infrastructure or ecosystems impacted. Currently, much attribution science is focused on the hazard. However, in recent years confidence has increased that detected impacts on ecosystems and human systems globally are attributable to climate change, including the impact of extreme events (IPCC WGII AR6).”

Studies have analysed loss of life from individual cold-and heat-related events[1] and monetary losses from flooding[2]. But attributing a wide range of quantifiable and more qualitative impacts poses challenges, such as how to incorporate vulnerability or assess the ‘value’ of cultural impacts. Addressing this is an active area of research[3].

Extreme event impact attribution itself is a growing area of research and there is a diversity of views among experts on the potential role extreme event attribution has to play in Loss and Damage decision-making[4]. Key evidence gaps relate to the lack of climate impact monitoring and data in some regions.

With regards to the exposure and vulnerability of communities to an extreme event, an added layer of complexity arises when considering climate change adaptation and the impact this had or could have had on the impact of an event. We discussed this challenge last year in a blog post on adaptation monitoring, and earlier this year the UK’s Climate Change Committee published their Adaptation Monitoring Framework. However, this framework acknowledges the challenges that still remain such as the interdependencies between sectors and other societal goals, and the fact that adaptation needs are very location and context specific.

Met Office expertise

As a global leader in weather and climate science and their many applications, the Met Office expertise spans observations and monitoring, developing and applying weather and climate information, and cutting-edge science including climate change attribution. Not only does this allow us to add our research to the growing evidence-base in reports such as those produced by the IPCC, but also places us in a position to support society directly in understanding the impacts of climate change and how these can be addressed.

We work with UK Government departments, industry and business, hydro-met and climate organisations in other nations and their stakeholders to share our science and expertise and to develop climate services which can help inform adaptation and increase resilience in the UK and beyond.

Richard concluded: “The discussion around Loss and Damage is a complex one, but climate science can play a part in increasing understanding and providing evidence to inform decision-making. Organisations such as the Met Office continue to develop climate science and can help to integrate this with research and knowledge from other specialisms such as those within the social sciences.”

Footnotes

1 Christidis, N., Donaldson, G.C. and Stott, P.A., 2010. Causes for the recent changes in cold-and heat-related mortality in England and Wales. Climatic Change, 102(3), pp.539-553.; Mitchell, D., Heaviside, C., Vardoulakis, S., Huntingford, C., Masato, G., Guillod, B.P., Frumhoff, P., Bowery, A., Wallom, D. and Allen, M., 2016. Attributing human mortality during extreme heat waves to anthropogenic climate change. Environmental Research Letters, 11(7), p.074006. and

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2 Schaller, N., Kay, A.L., Lamb, R., Massey, N.R., Van Oldenborgh, G.J., Otto, F.E., Sparrow, S.N., Vautard, R., Yiou, P., Ashpole, I. and Bowery, A., 2016. Human influence on climate in the 2014 southern England winter floods and their impacts. Nature Climate Change, 6(6), pp.627-634. and

Environment Agency Flood and coastal erosion risk management report: 1 April 2019 to 31 March 2020, updated March 2023.

3 Mechler, R., Bouwer, L.M., Schinko, T., Surminski, S. and Linnerooth-Bayer, J., 2019. Loss and damage from climate change: Concepts, methods and policy options (p. 557). Springer Nature

4 King, A.D., Grose, M.R., Kimutai, J. et al. Event attribution is not ready for a major role in loss and damage. Nat. Clim. Chang. 13, 415–417 (2023). https://doi.org/10.1038/s41558-023-01651-2

Date Created

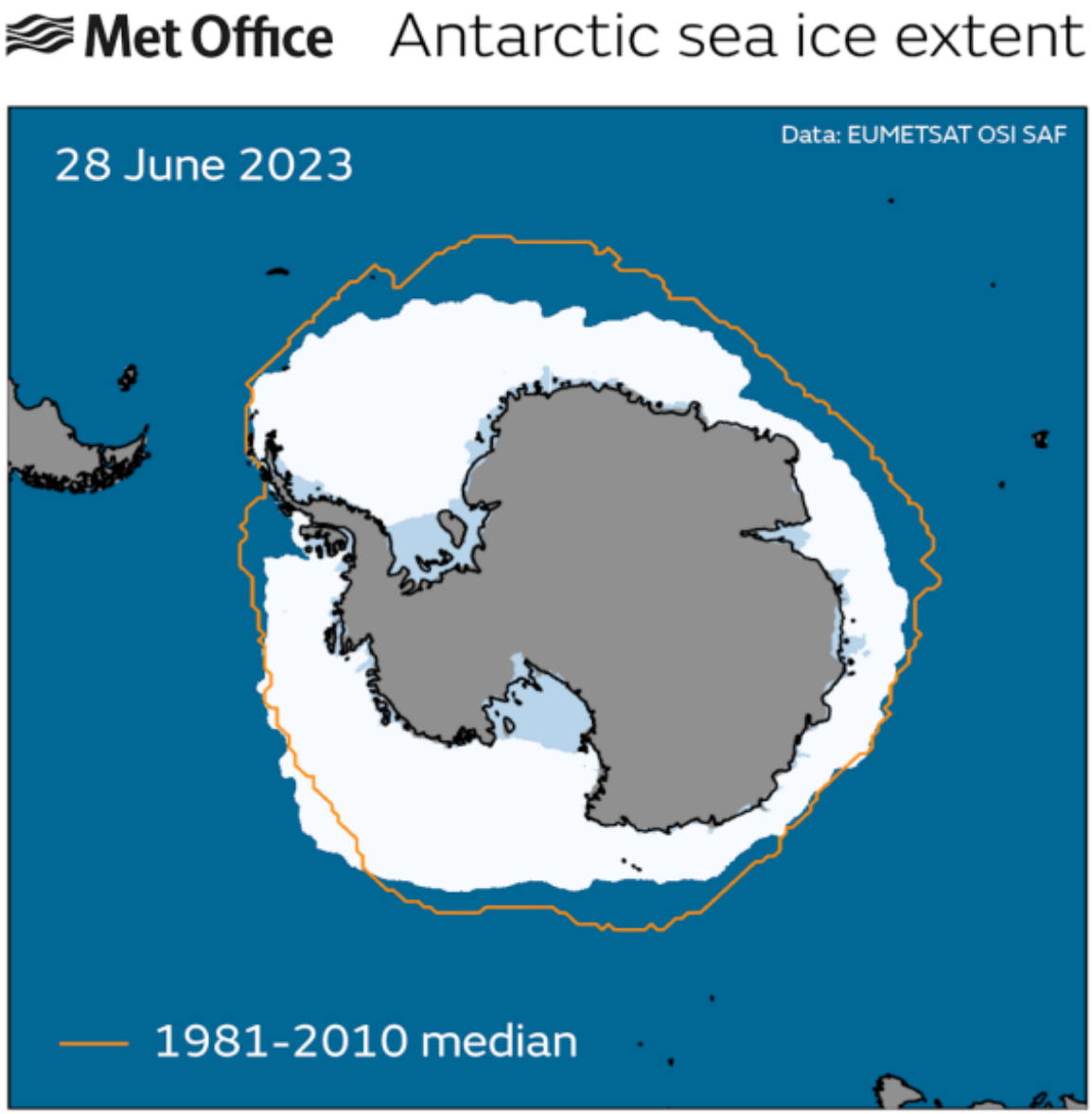
June 2023

Antarctic sea ice hits record low

Description

The extent of sea ice around Antarctica is at a record low for the end of June.

The current Antarctic sea ice extent is over 1.3 million sq km below the next lowest recorded extent for the time of year. That shortfall is more than five times the surface area of the UK.

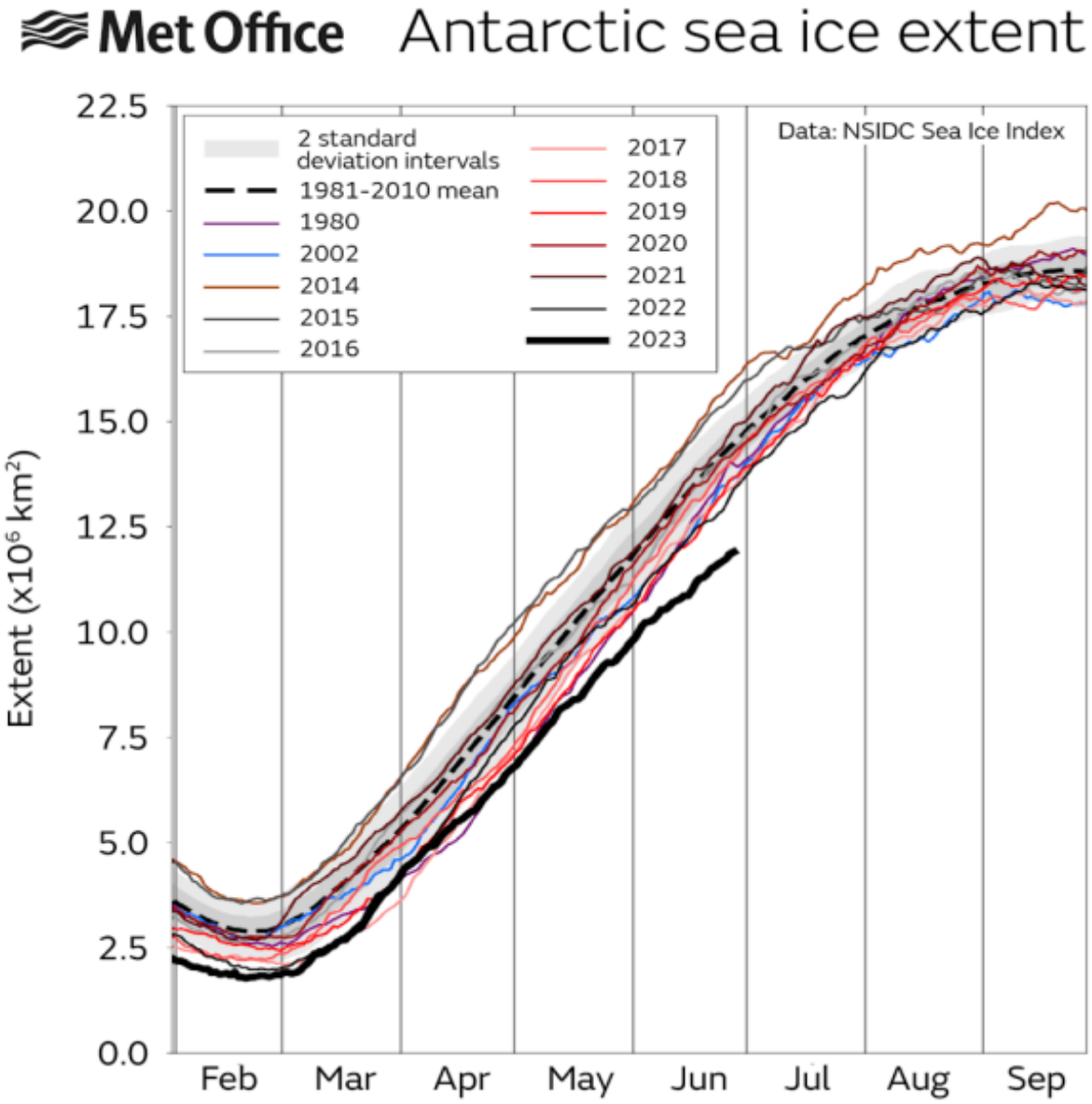


Dr Ed Blockley leads the Met Office's Polar Climate Group. He said: "Antarctic sea ice extent reaches a maximum around the end of September and a minimum around the end of February. At the end of

June, the extent of sea ice should be building to a mid-point between the maximum and the minimum. However, this year the ice is expanding very slowly with the consequence that the extent is way below the long-term (1981-2010) average.

“The annual minimum extent in February 2023 was the lowest since satellite records began in 1979, just over one million square kilometres below the long-term average., The current extent is extraordinarily low: it is in excess of 2.5 million square kilometres below average for the time of year.”

Researchers around the world are striving to understand why the extent of Antarctic sea ice isn’t coming back at the rate it should be. Higher air temperatures and anomalous atmospheric circulation patterns around the continent could be a part of the issue.



As winter around the Antarctic continent continues the average temperature will reduce, which will allow time for the ice extent to increase further. Ed Blockley added: “It is too early to speculate whether

ice extent will remain at extremely low levels. There is still time this season for the ice to recover but given the record lows we have seen we have to remain concerned about the likelihood of a record low winter maximum.”

Date Created
June 2023